F-5A

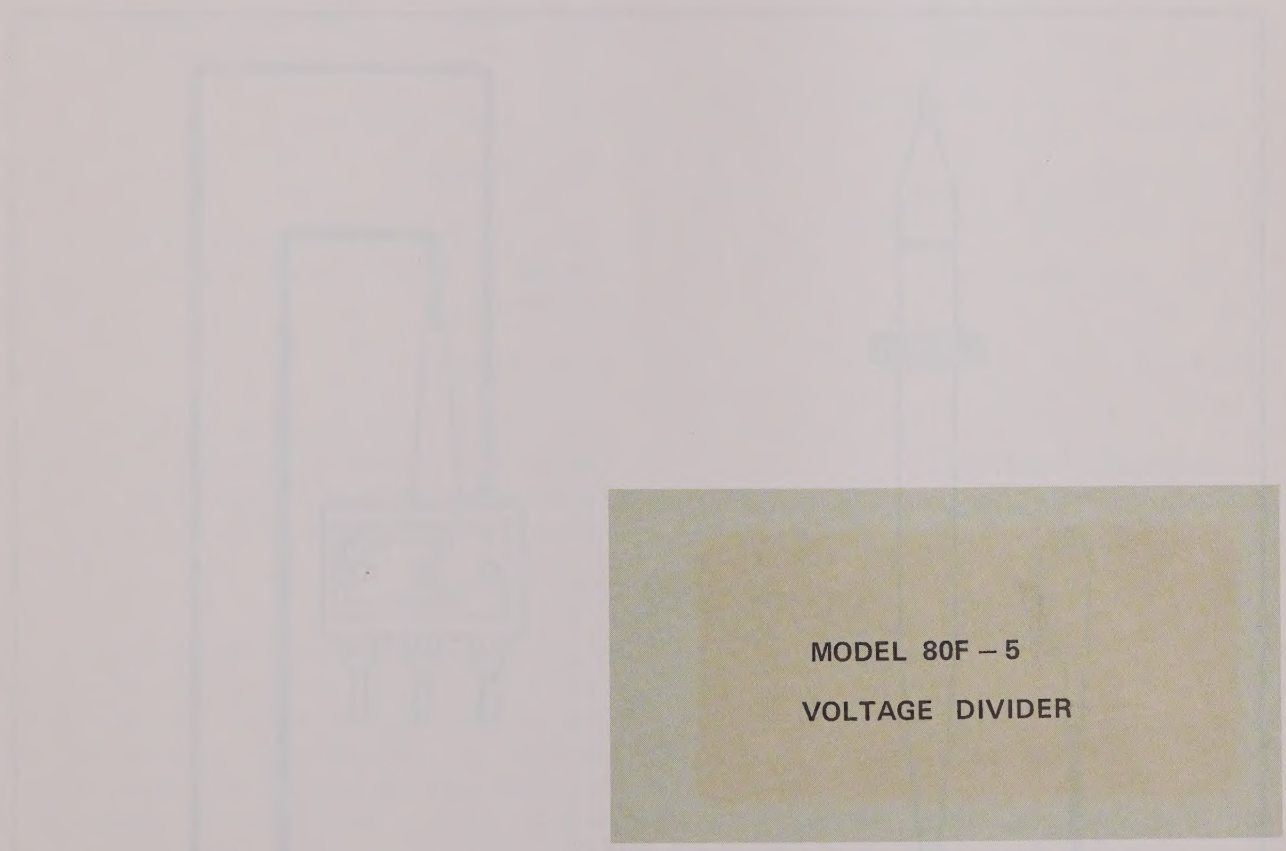
Instruction Manual

MODEL 80F – 5

VOLTAGE DIVIDER

FLUKE

ELECTRONICS FOR INDUSTRY
INSTRUMENTS / COMPONENTS



MODEL 80F – 5

VOLTAGE DIVIDER

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ACCESSORY INFORMATION

MODEL 80F-5 VOLTAGE DIVIDER

6-1. INTRODUCTION

6-2. The Accessory Model 80F-5 Voltage Divider allows measurement of up to 5k volts dc to be made using FLUKE 800, 900, and 8000 series voltmeters. Division ratio of this accessory is 1000:1. Accuracy and stability of the division ratio is ensured using special metal film resistors having matched temperature coefficients.

6-3. Physical design of the Model 80F-5 allows direct mating to the input terminals of the FLUKE voltmeters. A high voltage probe facilitates connection to the measure-

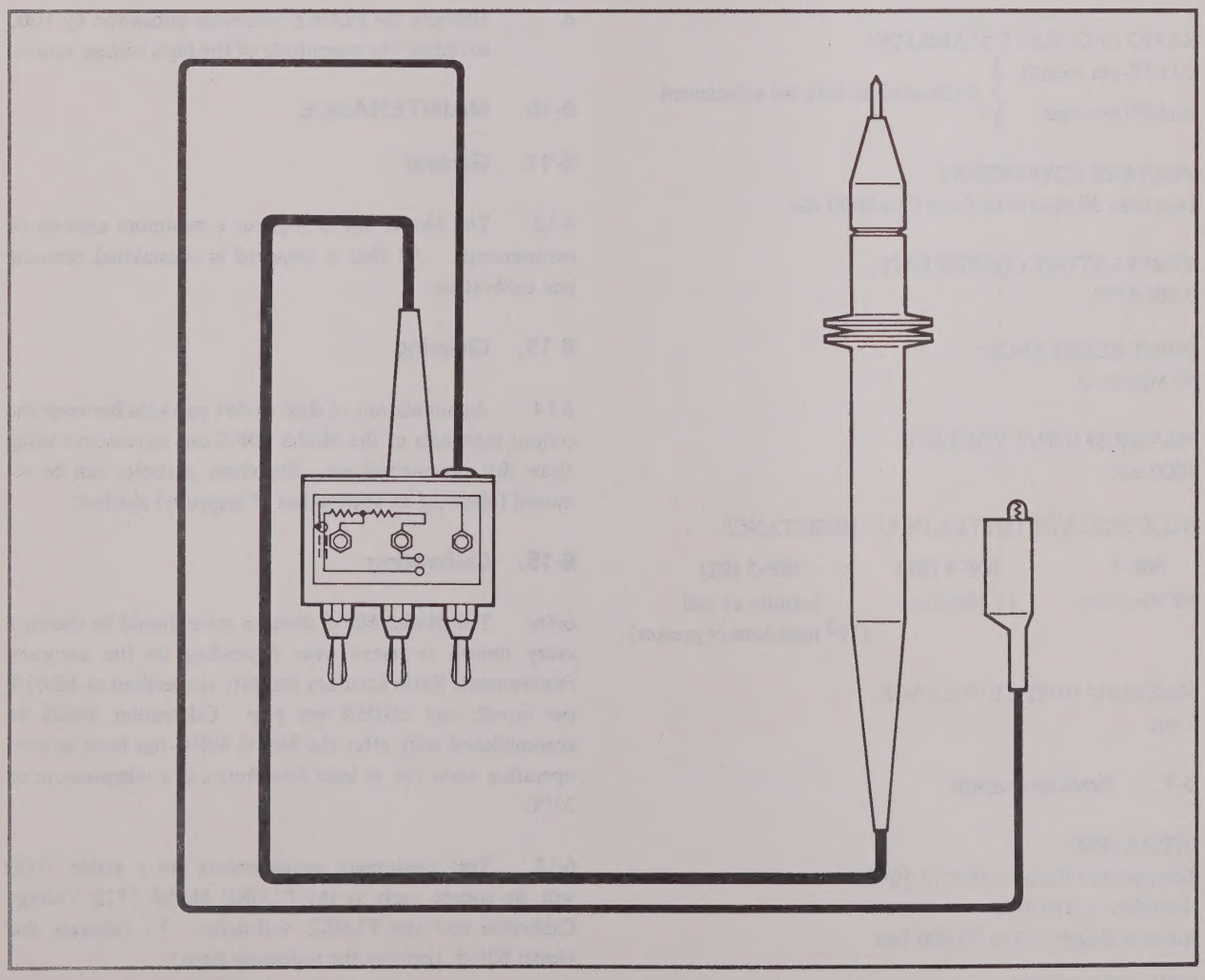

Figure 6-1. MODEL 80F-5 VOLTAGE DIVIDER

ment source. Maintenance is minimized by encapsulation of the divider components.

6-4. Three versions of the Model 80F-5 are available. The basic Model 80F-5 is used with voltmeters having a 10 megohm input resistance. An (01) Option is provided for voltmeters having an 11 megohm input resistance, and an (02) Option is provided for voltmeters having an infinite input resistance (10^3 megohms or greater) at null.

6-5. SPECIFICATIONS

6-6. Electrical

DIVISION RATIO:
1000:1

RATIO ACCURACY:
±0.01% of input from 500 to 5000 vdc.

RATIO ACCURACY STABILITY:
±0.01% per month
±0.05% per year } Calibrated by internal adjustment

VOLTAGE COEFFICIENT:
Less than 20 ppm total from 0 to 5000 vdc.

TEMPERATURE COEFFICIENT:
0.001%/°C

INPUT RESISTANCE:
50 Megohms

MAXIMUM INPUT VOLTAGE:
5000 vdc

REQUIRED VOLTMETER INPUT RESISTANCE:

80F-5	80F-5 (01)	80F-5 (02)
10 Megohms	11 Megohms	Infinite at null (10^3 megohms or greater)

MAXIMUM OUTPUT VOLTAGE:
5 vdc

6-7. Environmental

OPERATING:
Temperature Range – 0°C to 50°C
Humidity – 0 to 80%
Altitude Range – 0 to 10,000 feet

NON-OPERATING:
Altitude Range – 0 to 50,000 feet

6-8. Mechanical

WEIGHT:
20 ounces (340 grams)

DIMENSIONS
2.28 inches high x 1.52 inches wide x 1.525 inches deep.

6-9. OPERATING INSTRUCTIONS

a. Connect the Model 80F-5 output terminals directly to the INPUT terminals of the FLUKE voltmeter.

b. Select the appropriate dc voltage range on the FLUKE voltmeter.

c. Connect the high voltage probe and ground clip to the high voltage source.

d. Multiply the FLUKE voltmeter indication by 1000 to obtain the magnitude of the high voltage source.

6-10. MAINTENANCE

6-11. General

6-12. The Model 80F-5 requires a minimum amount of maintenance. All that is required is occassional cleaning and calibration.

6-13. Cleaning

6-14. Accumulation of dust or dirt particles between the output terminals of the Model 80F-5 can be removed using clean dry pressurized air. Stubborn particles can be removed following an application of isopropyl alcohol.

6-15. Calibration

6-16. The Model 80F-5 division ratio should be checked every month or every year depending on the accuracy requirement. Ratio accuracy stability is specified at ±0.01% per month and ±0.05% per year. Calibration should be accomplished only after the Model 80F-5 has been in non-operating state for at least four hours at a temperature of 23°C.

6-17. Test equipment requirements are a stable 1000 volt dc source such as the FLUKE Model 332B Voltage Calibrator and the FLUKE voltmeter. To calibrate the Model 80F-5, perform the following steps:

a. Calibrate the FLUKE voltmeter.

b. Install the Model 80F-5 on the FLUKE voltmeter input terminals.

c. Unscrew the strain relief on the input cable of the Model 80F-5 and remove the front cover.

d. Select the appropriate dc voltage range on the FLUKE voltmeter.

e. Apply 1000 volts dc to the Model 80F-5 high voltage probe.

f. Adjust the variable resistor on the Model 80F-5 for a 1.0 volt dc indication on the FLUKE voltmeter.

g. Remove the voltage from the Model 80F-5 high voltage probe.

h. Install the Model 80F-5 front cover and strain relief.

Appendix A

Federal Supply Code for Manufacturers

A-1. CODE TO NAME

A-2. The following five-digit code numbers are listed in numerical sequence along with the manufacturer's name and address to which the code has been assigned. The Federal Supply Code has been taken from Cataloging Handbook H 4-2, Code to Name.

00213 Sage Electronics Corp.
Rochester, New York

00327 Welwyn International, Inc.
Westlake, Ohio

00656 Aerovox Corp.
New Bedford, Massachusetts

00779 AMP Inc.
Harrisberg, Pennsylvania

01121 Allen-Bradley Co.
Milwaukee, Wisconsin

01281 TRW Semiconductors
Lawndale, California

01295 Texas Instruments, Inc.
Semiconductor Components Div.
Dallas, Texas

01686 RCL Electronics Inc.
Manchester, New Hampshire

01730 Deleted

01884 Dearborn Electronics Inc.
Orlando, Florida

02114 Ferroxcube Corp.
Saugerties, New York

02606 Replaced by 15801

02660 Amphenol-Borg Elect. Corp.
Broadview, Illinois

02799 Arco Capacitors, Inc.
Los Angeles, California

03614 Replaced by 71400

03651 Replaced by 44655

03797 Eldema Corp.
Compton, California

03877 Transitron Electronic Corp.
Wakefield, Massachusetts

03888 Pyrofilm Resistor Co., Inc.
Cedar Knolls, New Jersey

03911 Clairex Corp.
New York, New York

03980 Muirhead Instruments, Inc.
Mountainside, New Jersey

04009 Arrow Hart and Hegemen
Electronic Company
Hartford, Connecticut

04062 Replaced by 72136

04202 Replaced by 81312

04217 Essex Wire Corp.
Wire & Cable Div.
Anaheim, California

04221 Aemco
Div. of Midtex Inc.
Mankato, Minnesota

04645 Replaced by 75376

04713 Motorola Semiconductor
Products Inc.
Phoenix, Arizona

05082 Replaced by 94154

05236 Jonathan Mfg. Co.
Fullerton, California

05277 Westinghouse Electric Corp.
Semiconductor Dept.
Youngwood, Pennsylvania

05278 Replaced by 43543

05397 Union Carbide Corp.
Electronics Div.
Cleveland, Ohio

05571 Sprague Electric Co
Pacific Div.
Los Angeles, California

05704 Alac, Inc.
Glendale, California

05820 Wakefield Engineering Ind.
Wakefield, Massachusetts

06001 General Electric Company
Capacitor Department
Irmo, South Carolina

06136 Replaced by 63743

06473 Amphenol Space & Missile Sys.
Chatsworth, California

06555 Beede Electrical Instrument Co.
Penacook, New Hampshire

06739 Electron Corp.
Littletown, Colorado

06743 Clevite Corp.
Cleveland, Ohio

06751 Semcor Div. Components
Phoenix, Arizona

06860 Gould National Batteries Inc.
City of Industry, California

06980 Eitel-McCullough, Inc.
San Carlos, California

07115 Replaced by 14674

07138 Westinghouse Electric Corp.
Electronic Tube Div.
Elmira, New York

07263 Fairchild Semiconductor
Div. of Fairchild Camera
& Instrument Corp.
Mountain View, California

07344 Bircher Co., Inc.
Rochester, New York

07792 Lerma Engineering Corp.
Northampton, Massachusetts

07910 Continental Device Corp.
Hawthorne, California

08530 Reliance Mica Corp.
Brooklyn, New York

08792 CBS Electronics Semiconductor
Operations-Div. of CBS Inc.
Lowell, Massachusetts

08806 General Electric Co.
Miniature Lamp Dept.
Cleveland, Ohio

08863 Nylomatic Corp.
Norrisville, Pennsylvania

08988 Skottie Electronics Inc.
Archbald, Pennsylvania

09922 Burndy Corp.
Norwalk, Connecticut

11237 Chicago Telephone of Calif. Inc.
South Pasadena, California

11358 CBS Electronics
Div. of CBS Inc.
Newburyport, Massachusetts

11403 Best Products Co.
Chicago, Illinois

11503 Keystone Mfg.
Div. of Avis Industrial Corp.
Warren, Michigan

12014 Chicago Rivet & Machine Co.
Bellwood, Illinois

12040 National Semiconductor Corp.
Danburry, Connecticut

12060 Diodes, Inc.
Chatsworth, California

12136 Philadelphia Handle Co.
Camden, New Jersey

12323 Presin Co., Inc.
Shelton, Connecticut

12327 Freeway Washer & Stamping Co.
Cleveland, Ohio

12400 Replaced by 75042

12617 Hamlin Inc.
Lake Mills, Wisconsin

12697 Clarostat Mfg. Co.
Dover, New Hampshire

12749 James Electronics
Chicago, Illinois

12856 Micrometals
Sierra Madre, California

12954 Dickson Electronics Corp.
Scottsdale, Arizona

13606 Sprague Electric Co.
Transistor Div.
Concord, New Hampshire

13839 Replaced by 23732

14099 Semtech Corp.
Newbury Park, California

14193 California Resistor Corp.
Santa Monica, California

14298 American Components, Inc.
Conshohocken, Pennsylvania

14655 Cornell-Dubilier Electronics
Newark, New Jersey

14674 Corning Glass Works
Corning, New York

14752 Electro Cube Inc.
San Gabriel, California

14869 Replaced by 96853

15636 Elec-Trol Inc.
Northridge, California

15801 Fenwal Electronics Inc.
Framingham, Massachusetts

15818 Amelco Semiconductor
Div. of Teledyne Inc.
Mountain View, California

15849 Useco, Inc.
Mt. Vernon, New York

15909 Replaced by 17870

16332 Replaced by 28478

16473 Cambridge Scientific Ind. Inc.
Cambridge, Maryland

16742 Paramount Plastics
Downey, California

16758 Delco Radio
Div. of General Motors
Kokomo, Indiana

17069 Circuit Structures Lab.
Upland, California

17856 Siliconix, Inc.
Sunnyvale, California

17870 Daven-Div. of Thomas A. Edison
Ind. --McGraw-Edison Co.
Manchester, New Hampshire

18083 Deleted

18178 Vactec Inc.
Maryland Heights, Missouri

18736 Voltronics Corp.
Hanover, New Jersey

19429 Montronics, Inc.
Seattle, Washington

19451 Perine Machinery & Supply Co.
Seattle, Washington

19701 Electra Mfg. Co.
Independence, Kansas

20584 Enochs Mfg. Co.
Indianapolis, Indiana

22767 ITT Semiconductors
Div. of ITT
Palo Alto, California

23732 Tracor
Rockville, Maryland

24248 Southco
Div. of South Chester Corp.
Lester, Pennsylvania

24655 General Radio Co.
West Concord, Massachusetts

25403 Amperex Electronic Corp
Semiconductor & Receiving
Tube Division
Slatersville, Rhode Island

28478 Deltrol Controls Corp.
Milwaukee, Wisconsin

28520 Heyman Mfg. Co.
Kenilworth, New Jersey

30323 Illinois Tool Works Inc.
Chicago, Illinois

33173 General Electric Co.
Tube Dept.
Owensboro, Kentucky

37942 Mallory, P. R., & Co., Inc.
Indianapolis, Indiana

38315 Honeywell Inc.
Precision Meter Div.
Manchester, New Hampshire

42498 National Company
Melrose, Massachusetts

43543 Nytronics Inc.
Transformer Co. Div.
Alpha, New Jersey

44655 Ohmite Mfg. Co.
Skokie, Illinois

49671 Radio Corp. of America
New York, New York

49956 Raytheon Company
Lexington, Maine

53021 Sangamo Electric Co.
Springfield, Illinois

55026 Simpson Electric Company
Chicago, Illinois

56289 Sprague Electric Co.
North Adams, Massachusetts

58474 Superior Electric Co.
Bristol, Connecticut

60399 Torrington Mfg. Co.
Torrington, Connecticut

62460 Deleted

63743 Ward Leonard Electric Co.
Mount Vernon, New York

64834 West Mfg. Co.
San Francisco, California

65092 Weston Instruments Inc.
Newark, New Jersey

66150 Winslow Tele-Tronics Inc.
Asbury Park, New Jersey

70563 Amperite Company
Union City, New Jersey

70903 Belden Mfg. Co.
Chicago, Illinois

71002 Birnbach Radio Co., Inc.
New York, New York

71400 Bussmann Mfg.
Div. of McGraw-Edison Co.
St. Louis, Missouri

71450 CTS Corp.
Elkhart, Indiana

71468 ITT Cannon Electric Inc.
Los Angeles, California

71482 Clare, C. P. & Co.
Chicago, Illinois

71590 Centralab
Div. of Globe Union Inc.
Milwaukee, Wisconsin

71707 Coto Coil Co., Inc.
Providence, Rhode Island

71744 Chicago Miniature Lamp Works
Chicago, Illinois

71785 Cinch Mfg. Co. & Howard
B. Jones Div.
Chicago, Illinois

72005 Driver, Wilber B., Co.
Newark, New Jersey

72092 Replaced by 06980

72136 Electro Motive Mfg. Co.
Willimantic, Connecticut

72259 Nytronics Inc.
Berkeley Heights, New Jersey

72354 Deleted

72619 Dialight Corp
Brooklyn, New York

72653 G. C. Electronics
Rockford, Illinois

72665 Replaced by 90303

72794 Dzus Fastener Co., Inc.
West Islip, New York

72928 Gudeman Co.
Chicago, Illinois

72982 Erie Tech. Products Inc.
Erie, Pennsylvania

73138 Beckman Instruments Inc.
Helipot Division
Fullerton, California

73293 Hughes Aircraft Co.
Electron Dynamics Div.
Newport Beach, California

73445 Amperex Electronic Corp.
Hicksville, New York

73559 Carling Electric Inc.
Hartford, Connecticut

73586 Circle F Industries
Trenton, New Jersey

73734 Federal Screw Products, Inc.
Chicago, Illinois

73743 Fischer Special Mfg. Co.
Cincinnati, Ohio

73899 JFD Electronics Co.
Brooklyn, New York

73949 Guardian Electric Mfg. Co.
Chicago, Illinois

74199 Quam Nichols Co.
Chicago, Illinois

74217 Radio Switch Corp.
Marlboro, New Jersey

74276 Signalite Inc.
Neptune, New Jersey

74306 Piezo Crystal Co.
Carlisle, Pennsylvania

74542 Hoyt Elect. Instr. Works
Penacook, New Hampshire

74970 Johnson, E. F., Co.
Waseca, Minnesota

75042 IRC Inc.
Philadelphia, Pennsylvania

75376 Kurz-Kasch, Inc.
Dayton, Ohio

75382 Kulka Electric Corp.
Mt. Vernon, New York

75915 Littlefuse Inc.
Des Plaines, Illinois

76854 Oak Mfg. Co.
Crystal Lake, Illinois

77342 Potter & Brumfield
Div. of Amer. Machine & Foundry
Princeton, Indiana

77969 Rubbercraft Corp. of Calif. LTD.
Torrance, California

78189 Shakeproof
Div. of Illinois Tool Works
Elgin, Illinois

78277 Sigma Instruments, Inc.
South Braintree, Massachusetts

78488 Stackpole Carbon Co.
St. Marys, Pennsylvania

78553 Tinnerman Products
Cleveland, Ohio

79136 Waldes Kohinoor Inc.
Long Island City, New York

79497 Western Rubber Company
Goshen, Indiana

79963 Zierick Mfg. Corp.
New Rochelle, New York

80031 Mepco
Div. of Sessions Clock Co.
Morristown, New Jersey

80145 API Instruments Co.
Chesterland, Ohio

80183 Sprague Products
North Adams, Massachusetts

80294 Bourns Inc.
Riverside, California

80583 Hammarlund Co., Inc.
Mars Hill, North Carolina

80640 Stevens, Arnold Inc.
Boston, Massachusetts

81073 Grayhill Inc.
La Grange, Illinois

81312 Winchester Electronics
Div. of Litton Industries
Oakville, Connecticut

81439 Therm-O-Disc Inc.
Mansfield, Ohio

81483 International Rectifier Corp.
El Segundo, California

81590 Korry Mfg. Co.
Seattle, Washington

82376 Deleted

82389 Switchcraft Inc.
Chicago, Illinois

82415 Price Electric Corp.
Frederick, Maryland

82872 Roanwell Corp.
New York, New York

82877 Rotron Mfg. Co., Inc.
Woodstock, New York

82879 ITT Wire & Cable Div.
Pawtucket, Rhode Island

83003 Varo Inc.
Garland, Texas

83298 Bendix Corp.
Electric Power Division
Eatontown, New Jersey

83330 Smith, Herman H., Inc.
Brooklyn, New York

83478 Rubbercraft Corp. of America
New Haven, Connecticut

83594 Burroughs Corp.
Electronic Components Div.
Plainfield, New Jersey

83740 Union Carbide Corp.
Consumer Products Div.
New York, New York

84171 Arco Electronics, Inc.
Great Neck, New York

84411 TRW
Ogallala, Nebraska

86577 Precision Metal Products
Stoneham, Massachusetts

86684 Radio Corp. of America
Electronic Components &
Devices
Harrison, New Jersey

86689 Deleted

87034 Marco-Oak Inc.
Anaheim, California

88419 Use 14655

88690 Replaced by 04217

89536 Fluke, John Mfg. Co., Inc.
Seattle, Washington

89730 Replaced by 08806

90201 Mallory Capacitor Co.
Indianapolis, Indiana

90215 Best Stamp & Mfg. Co.
Kansas City, Missouri

90211 Square D Co.
Chicago, Illinois

90303 Mallory Battery Co.
Tarrytown, New York

91293 Johanson Mfg. Co.
Boonton, New Jersey

91407 Replaced by 58474

91637 Dale Electronics Inc.
Columbus, Nebraska

91662 Elco Corp.
Willow Grove, Pennsylvania

91737 Gremar Mfg. Co., Inc.
Wakefield, Massachusetts

91802 Industrial Devices, Inc.
Edgewater, New Jersey

91836 King's Electronics
Tuckahoe, New York

91929 Honeywell Inc.
Micro Switch Div.
Freeport, Illinois

91934 Miller Electric Co., Inc.
Pawtucket, Rhode Island

93332 Sylvania Electric Products
Semiconductor Products Div.
Woburn, Massachusetts

94145 Replaced by 49956

94154 Tung-Sol
Div. of Wagner Electric Corp.
Newark, New Jersey

95146 Alco Electronics Products Inc.
Lawrence, Massachusetts

95263 Leecraft Mfg. Co.
Long Island City, New York

95264 Replaced by 98278

95275 Vitramon Inc.
Bridgeport, Connecticut

95303 Radio Corp. of America
Solid State & Receiving Tube Div.
Cincinnati, Ohio

95354 Methode Mfg. Corp.
Rolling Meadows, Illinois

95712 Dage Electric Co., Inc.
Franklin, Indiana

95987 Weckesser Co., Inc.
Chicago, Illinois

96733 San Fernando Electric Mfg. Co.
San Fernando, California

96853 Rustrak Instrument Co.
Manchester, New Hampshire

96881 Thomson Industries, Inc.
Manhasset, New York

97540 Master Mobile Mounts
Div. of Whitehall Electronics Corp.
Los Angeles, California

97913 Industrial Electronic Hdware Corp.
New York, New York

97945 White, S. S. Co.
Plastics Div.
New York, New York

97966 Replaced by 11358

98094 Replaced by 49956

98278 Microdot Inc.
Pasadena, California

98291 Sealectro Corp.
Conhex Div
Mamaroneck, New York

98388 Accurate Rubber & Plastics
Culver City, California

98743 Replaced by 12749

98925 Deleted

99120 Plastic Capacitors, Inc.
Chicago, Illinois

99217 Southern Electronics Corp.
Burbank, California

99515 Marshall Industries
Capacitor Div.
Monrovia, California

Appendix B

List of Abbreviations

a, amp	ampere
ampl	amplifier
ac	alternating current
assy	assembly
BCD	binary coded decimal
cap	capacitor
car	carbon
cm	centimeter
C	centigrade
cer	ceramic
cw	clockwise
CMRR	common mode rejection ratio
comp	composition
CCW	counterclockwise
conn	connector
CRT	cathode ray tube
cps	cycles per second
db	decibel
dvm	digital voltmeter
dc	direct current
dpdt	double-pole, double-throw
dpst	double-pole, single-throw
elect	electrolytic
ext	external
F	fahrenheit
f	farad
FET	field effect transistor
flm	film
Ge	germanium
g	giga or 10^9
gnd	ground
gmv	guaranteed minimum value
grd	guard
h	henry
Hz	hertz
hf	high frequency
IC	integrated circuit
if	intermediate frequency
int	internal
kc	kilocycle
k	kilo (10^3)
lf	low frequency
mc	megacycle
M	meg or mega (10^6)
met	metal
MOS	metal oxide silicon
μ	micro or 10^{-6}
m	milli or 10^{-3}
mm	millimeter
n	nano or 10^{-9}
neg	negative
Ω	ohm
osc	oscilloscope
ppm	parts per million
piv	peak inverse voltage
p-p	peak to peak
p	pico or 10^{-12}
plstc	plastic
$\pm$	plus or minus
pos	positive
pps	pulses per second
PCB	printed circuit board
QTY	quantity
rf	radio frequency
rfi	radio frequency interference
REC	recommended
REF	reference
RH	relative humidity
res	resistor
rms	root mean square
rtry	rotary
sec	second
sect	section
S/N	serial number
Si	silicon
scr	silicon controlled rectifier
spdt	single-pole, double-throw
spst	single-pole, single-throw
sw	switch
Ta	tantalum
TC	temperature coefficient
t	tera or 10^{12}
xfmr	transformer
tstr	transistor
tvm	transistor voltmeter
uhf	ultra high frequency
vtvm	vacuum tube voltmeter
var	variable
vhf	very high frequency
vlf	very low frequency
v	volt
VCO	voltage controlled oscillator
w	watt
ww	wire wound

Appendix C

Sales Representatives & Service Centers

ALABAMA

HUNTSVILLE
BCS Associates, Inc.
2317 Bob Wallace Ave.
P.O. Box 1273
Tel. (205) 881-6220
Zip 35807

ALASKA

SEATTLE
Showalter-Judd, Inc.
1806 S. Bush Place
Seattle, Washington 98144
Tel. (206) 324-7911

ARIZONA

*PHOENIX
Barnhill Associates
537 E. Osborn Road, Suite 4
Tel. (602) 263-1250
Zip 85012

CALIFORNIA

***LOS ANGELES
Instrument Specialists, Inc.
1109 S. Central Ave.
Glendale, California 91204
Tel (213) 245-9404

**SANTA CLARA
Instrument Specialists, Inc.
2359 De La Cruz Blvd.
Tel. (408) 244-1505
Zip 95050

SAN DIEGO
Instrument Specialists, Inc.
1901 State St.
Tel. (714) 232-2017
Zip 92101

COLORADO

*DENVER
Barnhill Associates
1170 S. Sheridan Blvd.
Tel. (303) 934-5505
Zip 80226

CONNECTICUT

HARTFORD
Instrument Representatives, Inc.
P. O. Box 165
Glastonbury, Connecticut 06033
Tel (203) 633-0777

FLORIDA

**ORLANDO
BCS Associates, Inc.
940 N. Fern Creek Ave.
P.O. Box 6578
Tel. (305) 843-1510
Zip 32803

GEORGIA

ATLANTA
BCS Associates, Inc.
1230 Briar Hill Dr.
Tel. (404) 874-9925
Zip 30306

HAWAII

HONOLULU
Industrial Electronics, Inc.
646 Queen Street
P.O. Box 135
Tel. (808) 533-6095
Zip 96817

ILLINOIS

**CHICAGO
Cozzens & Cudahy, Inc.
9501 W. Devon Ave.
Rosemont, Illinois 60018
Tel. (312) 825-1144

INDIANA

INDIANAPOLIS
Cozzens & Cudahy, Inc.
Port O'Call Executive Ctr.
21 Beachway Drive
Tel. (317) 244-2456
Zip 46234

MARYLAND

**BALTIMORE
Electronic Marketing Assoc. Inc.
11501 Huff Court
Kensington, Maryland 20795
Tel. (301) 881-5300

MASSACHUSETTS

**BOSTON
Instrument Representatives, Inc.
1046 Massachusetts Avenue
Arlington, Massachusetts 02174
Tel. (617) 646-1034

MICHIGAN

DETROIT
WKM Associates, Inc.
1474 East Outer Dr.
Tel. (313) 892-2500
Zip 48234

MINNESOTA

MINNEAPOLIS
Cozzens & Cudahy, Inc.
7450 France Ave. So.
Tel. (612) 920-1022
Zip 55435

MISSOURI

ST. LOUIS
Cozzens & Cudahy, Inc.
P. O. Box 10013
Lambert Field - Zip 63145
Tel. (314) 423-1234

NEW JERSEY

**NEWARK
SBM Associates, Inc.
1519 Stuyvesant Avenue
Union, New Jersey 07083
Tel. (201) 687-8737

NEW MEXICO

*ALBUQUERQUE
Barnhill Associates
1410—D Wyoming N.E.
Tel. (505) 299-7658
Zip 87110

NEW YORK

*NEW YORK
SBM Associates, Inc.
28 Hobby Street
Pleasantville, N. Y. 10570
Tel. (914) 769-1811

**ROCHESTER
SBM Associates, Inc.
4515 Culver Rd.
Tel. (716) 266-1400
Zip 14622

NORTH CAROLINA

GREENSBORO
BCS Associates, Inc.
1039 E. Wendover Ave.
P.O. Box 6426
Tel. (919) 273-1918
Zip 27405

OHIO

*CLEVELAND
WKM Associates, Inc.
16141 Puritas Ave.
Tel. (216) 267-0445
Zip 44135

*DAYTON
WKM Associates, Inc.
6073 Far Hills Ave.
Tel. (513) 434-7500
Zip 45429

OREGON

PORTLAND
Showalter-Judd, Inc.
1445 N. E. Arrington
Hillsboro, Oregon 97123
Tel. (503) 648-6372

PENNSYLVANIA

PHILADELPHIA
Electronic Marketing Assoc.
210 Goddard Blvd.—Suite 100
King of Prussia, Pennsylvania
Tel (215) 248-5050
Zip 19406

PITTSBURGH
WKM Associates, Inc.
90 Clairton Blvd.
Tel. (412) 892-2953
Zip 15236

TEXAS

*DALLAS
Barnhill Associates
Suite 220
312 N. Central Express Wy.
Richardson, Texas 75080
Tel. (214) 231-2573

*HOUSTON
Barnhill Associates
Suite 332
3810 Westheimer
Tel. (713) 621-0040
Zip 77027

EAST VIRGINIA

WILLIAMSBURG
BCS Associates, Inc.
107 Rich Neck Road
Tel. (703) 229-5108
Zip 23185

WASHINGTON

SEATTLE
Showalter-Judd, Inc.
1806 S. Bush Place
Seattle, Washington 98144
Tel. (206) 324-7911

CANADA

BRITISH COLUMBIA

VANCOUVER
Allan Crawford Associates, Ltd.
1820 Pandora St.
Tel. (604) 253-7136

ONTARIO

*MALTON
Allan Crawford Associates, Ltd.
6427 Northam Drive.
Tel. (416) 678-1500

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